Manufacturing Data Elements Reference Document

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ABSTRACT: This reference document is one example of the engineering and manufacturing product data elements used for fabrication of prototypes and for volume manufacturing.

APPLICABILITY: Use of this reference document is recommended for 50-class boards, 54-class modules, and 70-class backplanes released by Digital.

STATUS: APPROVED 10-May-1991; use VTX SMC for current status.

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1 PRINTED-WIRING BOARD (PWB) MANUFACTURING DATA REQUIREMENTS

The following explanations will be helpful using the charts in this document.

1.1 DATA ELEMENTS

The *data elements* are listed in the left-most column of the chart. Typical attributes of each element are listed under most items when applicable.

1.2 DEFINITION/EXAMPLE

The data elements are followed by a brief definition or example of the expected data.

1.3 USAGE

The *usage* fields define the manufacturing environment and primary usage within the environment in which the data element is used. The *usage* section is subdivided into three columns representing the PWB (50), Module (54), and Backplane (70) manufacturing environments. Fabrication (F), Test (T), and Reference (R) flags are used in these columns to indicate the typical usage of the data element. For example, an FT under the 54 column indicates that a particular data element is typically used for fabrication and test of a module. Usage flags are indicated for the overall data element and not for individual attributes listed for each element.

NOTE

F and T indicate build elements; for additional information, refer to *DEC STD 140-4 Etch Board and Module Release Verification Requirements and Procedures - Data Requirements* (in process).

1.4 REQUIREMENTS

The Requirement (REQ) column defines when this data element is required by Manufacturing. An Always (A) flag indicates that this information is always required, independent of the product being described. A Product (P) flag indicates that this information is only necessary when the product being described uses the item defined. For example, information describing the physical outline of a PWB will always be required; information describing soldermask will only be required if the product uses soldermask.

1.5 SUPPLIER

The Supplier (SUP) column defines the organization responsible for providing this information to Manufacturing. An E in this column indicates Engineering as the responsible organization; an M indicates Manufacturing is responsible.

The following charts represent the minimum set of data elements and reference data required for the PWB fabrication and test processes.

NOTE

Although this data represents a description of the PWB, much of it is also used within the module manufacturing process.

2 KEY DEFINITION

The following key applies to all the tables that follow.

USAGE=	Mfg user	REQ	= Requirement	SUP	= Supplier of data
F	= Fabrication	A	= Always	E	= Engineering
T	= Test	P	= Product dependent	M	= Manufacturing
R	= Reference				

2.1 IDENTIFICATION INFORMATION

The following product identification information must be included.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Circuit Name/Number	Part name used to identify product	R			A	E
Circuit Revision	Part revision	R			A	E
Data Status	Indicator defining whether this data collection represents a release product, prototype, and so on	FT			A	E
Data Level	Indicator, defining level (50, 54, 70) of product represented by this collection of data	FT			A	E
Design Site	Three-character Digital location code of currently responsible design site	FT	FT		A	E
Designer	Name of responsible PC layout designer	FT	FT		A	E
Responsible Design Eng	Name of the responsible design engineer	FT	FT		A	E
Producibility Eng.	Name of the responsible producibility engineer	FT	FT		A	E

2.2 DOCUMENT INFORMATION

An index of all applicable product documentation must include the following information.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Document Number	Document numbers for all reference documentation applicable to manufacturing	FT			A	E
Document Revision	Document revisions for all reference documentation	FT			A	E
Document Type	MD, DD, ELEN, and so on	FT			A	E
Engineering Documents	Engineering drawings, specifications, or reports necessary for this product as specified in DEC STD 140-1, -2, and -3	R			A	E
Manufacturing Documents	Engineering drawings, specifications, or reports necessary for this product as specified in DEC STD 140-1, -2 & -3.	R			A	M

2.3 PHYSICAL CIRCUIT INFORMATION

The following physical circuit information must be included.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Circuit Dimensions		FT			A	E
Circuit Width	Width of finished circuit in inches					
Circuit Height	Height of finished circuit in inches					
Thickness	Thickness of finished circuit in inches					
Tolerance	Tolerances of circuit height, width, thickness					
Circuit Technology		FT			A	E
Technology Name	Generic name of technology or nonstandard					
Circuit Type	Generic name of circuit or nonstandard					

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	RE Q	SU P
Layer Construction	Defines layer or level configuration of the finished circuit Attributes required for each material level are:	FT			A	E
Level Number	Sequential number for this level of material					
Layer Number	Corresponding etch layer number, if applicable					
Level Attribute	Power/ground, dielectric, logic, impedance					
Material Type	Epoxy/glass, polyimide, copper, and so on					
Material Thickness Tolerances	Thickness of material level Positive and negative material tolerances					
Circuit Outline	Accurate outline of the finished circuit Attributes required for each line segment of the circuit outline are:	FT	FT		A	E
Begin XY	XY coordinates of segment begin point					
End XY	XY coordinates of segment end point					
Segment Type	Arc, circle, or line					
Arc flag	Right (clockwise) or left (counter-clockwise)					
Arc Center	XY coordinates of center of arc					
Circuit Holes	All holes located within the circuit envelope Attributes required for each circuit level hole are:	FT			P	E
XY Coordinates	Location of hole					
Diameter	Finished hole size					
From layer	First layer number where hole begins					
To layer	Last layer number where hole ends					
Usage	Hole type (test, feed-through, and so on					
Reference Designator	Associated component designator if applicable					
Pin Name	Associated hole with specific component pin					
Plating Flag	Y/N (Y=PTH, N=NPTH)					
Circuit Hole Summary	A summary of each unique hole size Attributes required for each hole size per layer combination are:	R			A	E
Hole Size	Finished hole diameter					
Tolerances	Positive and negative hole tolerances					
From layer	First layer number where hole begins					
To layer	Last layer number where hole ends					
Plating Flag	Y/N					
Total Hole Count	Total number of holes in this size/layer combination					

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Circuit Lines	All lines within circuit outline Attributes required for each segment are:	FT			P	E
Level Number	Board material level where line is located					
Begin Coordinates	Beginning XY coordinates of line segment					
Ending Coordinates	Ending XY coordinates of line segment					
Line Width	Width of line in mils					
Line End Shape	Ending shape of line segment					
Data Representation	Flag indicating presence/absence of material. (Clearance on copper plane layer)					
Circuit Line Summary	A summary of each unique line size Attributes required for each line size per layer per application are:	R			A	E
Total Line Count	Total number of lines					
Line Application	Etch, soldermask, nomenclature, resistive					
Layer number	Layer number where line width is found					
Line Width	Finished line width					
Line Tolerances	Positive and negative tolerances					
Circuit Pads	All pads located within the circuit Attributes required for each pad are: (Clearance on copper plane layer)	FT			P	E
Layer Number	Layer number where pad is located					
XY Coordinates	Coordinate location of pad					
Pad Shape	Shape of the pad					
Pad Dimension	Dimension of pad					
Pad Use	Via, test probe pad, mechanical mount					
Pad Signal Number	Network associated with pad					
Total Count	Total number of pads					
Data Representation	Flag indicating presence or absence of material					
Circuit Pad Summary	A summary of each unique pad size Attributes required for each pad type per layer per application are:	R			A	E
Total Line Count	Total number of pads					
Layer number	Layer number where pad is found					
Pad Category	Etch, soldermask, nomenclature, resistive					
Pad Tolerances	Positive and negative tolerances					

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Circuit Areas	All area information for each layer of PWB	FT			P	E
	Attributes required for each segment point of each area outline are:					
Area Category	Etch, soldermask, nomenclature, overall, and so on					
Layer Number	Layer number on which area is located					
Area Type	Fill or void					
Area Number	Reference number					
Point Number	Reference number of point within area					
Area Shape	Circle, polygon, or other closed figure					
Area Dimensions	Points to define all shapes					
Area Signal Number	Network associated with area					
Data representation	Flag indicating presence of material					
Circuit Text	All text information for each layer of the PWB	F			P	E
	Attributes required for each text string					
Layer Number	Layer number on which text is located					
XY Coordinates	Lower-left coordinate of text string					
Text Category	Etch, soldermask, nomenclature, resistive					
Text String	Contents of text string					
Text Length	Physical length of text string					
Text Width	Physical width of text string					
Character Font	Defined font, if necessary					
Rotation	0 to 359 degrees					
Mirroring	Mirrored about X or Y axis or neither					
Data representation	Flag indicating PWB features					
Circuit Symbols	Symbols are nonfunctional PWB features	FT			P	E
	Attributes required for each symbol are:					
Use	Etch, nomenclature, soldermask					
Symbol Name	Digital logo, UL frame					
Layer Number	Layer number on which symbol is located					
XY Coordinates	Lower-left coordinate of symbol					
Rotation	0 to 359 degrees					
Circuit Fingers	Summary of all finger positions used by the product	FT			P	E
	Attributes required for each finger are:					
Layer Number	Layer number on which finger is located					
Paddle Name	Name of paddle set in which finger lies					
Finger Name	Name of finger within paddle set					
Preferred Test Point	Test point reference coordinate					
Signal Number	Network number associated with finger					
Finger Description	Line segment description of finger (One description per finger type)					

2.4 ELECTRICAL CIRCUIT INFORMATION

The following electrical circuit information must be included.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Circuit Network	Describes all the signal information for the product	T			P	E
	Attributes required for each point with signal information per layer are:					
XY Coordinates	Location for this point					
Reference Designator	If applicable					
Pin Name	If applicable					
Pad/Hole Usage	Test probe, feed-through, mechanical, SMT component, tester hole pad					
Signal Number	Completed circuit signal number					
End Point Flag	Y/N					
Layer Signal Number	Individual layer signal number					
Layer End Point Flag	Y/N					
Functional Test Pt	Flag indicating functional test point					
HiPot Test		T			P	E
	Attributes required for each set of probe points are:					
XY Coordinates	Two probe points for test					
Voltage Level	Voltage level of test					
Time	Time duration of test					
Parametric Test	Attributes required for each set of parametric test points are:	T			P	E
Test Type	Type of parametric test					
XY Coordinates	Coordinates of two associated points					
Parameter Value	Nominal value of the tested parameter					
Tolerance Values	Upper and lower tolerance limits					
Planar Resistance Layer Test		T			P	E
	Attributes required for each set of planar resistor test points are:					
Component Reference Designator	Pin identifier					
XY Coordinates	Coordinates of two points on each side of individual resistor					
Resistance Value	Nominal value of resistor					
Tolerance Values	Upper and lower tolerance limits					

2.5 ASSEMBLY BOARD INFORMATION

The following assembly board information must be included.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Assembly Board Dimension		FT			A	M
	Attributes required for each assembly board are:					
Board Height	Height of finished assembly board					
Board Width	Width of finished assembly					
Tolerances	Positive and negative tolerances					
Assembly Board Outline	Accurate outline of the finished board	FT	FT		A	M
	Attributes required for each line segment of the board outline are:					
Begin XY	XY coordinates of segment begin point					
Segment Type	Arc, circle, or line					
Arc flag	Right (clockwise) or left (counter-clockwise)					
Arc Center	XY coordinates of center of arc					
Assembly Board Holes	All holes located within the outline of the circuit	FT	FT	T	P	M
	Attributes required for each hole are:					
XY Coordinates	Location of hole					
Diameter	Finished hole size					
From layer	First layer number where hole begins					
To layer	Last layer number where hole ends					
Usage	Hole type (test, feed-through, and so on)					
Reference Designator	Naming description for hole					
Pin Name	Associates hole with specific component pin					
Board Hole Summary	A summary of each unique hole size	R		R	A	E
	Attributes required for each hole size per layer combination are:					
Hole Size	Finished hole diameter					
Tolerances	+ and - hole tolerances					
From layer	First layer number where hole begins					
To layer	Last layer number where hole ends					
Plating Flag	Y/N					
Total Hole Count						

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE			REQ	SUP
		50	54	70	Q	P
Assembly Board Lines	All lines within board envelope	FT			P	E
	Attributes required for each segment are:					
Level Number	Board level that line is on					
Begin Coordinates	Beginning XY coordinates of line segment					
Ending Coordinates	Ending XY coordinates of line segment					
Line Number	Board reference for line					
Line Width	Width of line in mils					
Line End Shape						
Data Representation	Flag indicating presence of material					
Line Signal Number	Signal number associated with line					
Board Line Summary	A summary of each unique line size.	R			A	E
	Attributes required for each line size per layer per application are:					
Line Category	Etch, soldermask, nomenclature, resistive					
Total Line Count	Total number of lines					
Layer number	Layer number where line width is found					
Line Width	Finished line width					
Line Tolerances	Positive and negative tolerances					
Assembly Board Pads	All product pads present at board level	FT			A	E
	Attributes required for each pad are:					
Layer Number	Layer number that pad is on					
XY Coordinates	Coordinate location of pad					
Pad Shape	Shape of the pad					
Pad Dimension	Dimensions of pad					
Pad Category	Copper or absence of copper					
Pad Use	Test, feed-through, component, SMT, and so on					
Pad Signal Number	Network associated with pad					
Total Count	Total number of pads					
Data Representation	Flag indicating presence of material					
Board Pad Summary	A summary of each unique pad size	R			A	E
	Attributes required for each pad type per layer per application are:					
Total Line Count	Total number of pads					
Layer number	Layer number where pad is found					
Pad Use	Etch, soldermask, nomenclature, resistive					
Pad Tolerances	Positive and negative tolerances					

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Assembly Board Areas	All areas located within board area	FT			P	E
	Attributes required for each segment point of each area outline are:					
Area Category	Copper or absence of copper					
Layer Number	Layer number on which area is located					
Area Type	Fill or void					
Area Number	Reference number					
Point Number	Reference number of point within area					
Area Shape	Circle, polygon, or other closed figure					
Area Dimensions	Points to define all shapes					
Area Signal Number	Network associated with area					
Data representation	Flag indicating presence of material					
Assembly Board Text	All text strings within board area	F			P	M
	Attributes required for each text string are:					
Layer Number	Layer number on which text is located					
XY Coordinates	Lower left coordinate of text string					
Text Category	Copper or absence of copper					
Text String	Contents of text string					
Text Length	Physical length of text string					
Text Width	Physical width of text string					
Character Font	Defined font, if necessary					
Rotation	0 to 359 degrees					
Mirroring	Mirrored about X or Y axis or neither					
Data representation	Flag indicating PWB features					
Circuit Board Step and Repeat	Data describing the way in which a circuit is stepped and/or repeated onto a manufacturing assembly board	FT	FT		P	M
	Attributes required for circuit to board step and repeat are:					
XY Offsets	Lower left coordinates of stepped and repeated circuits					
Rotation	0, 90, 180 , or 270 degrees					
Mirroring	X or Y axis					

2.6 ELECTRICAL BOARD INFORMATION

The following electrical board information must be included.

PWB FABRICATION AND TEST DATA ELEMENTS		USAGE 50	USAGE 54	USAGE 70	REQ	SUP
Assembly Board Network	Data describing any networks existing outside of the circuit envelope Attributes required for each point with signal information per layer are:	T	T	T	P	M
XY Coordinates	Location for this point					
Reference Designator	If applicable					
Pin Name	If applicable					
Pad/Hole Usage	Test probe, feed-through , mechanical, SMT component, tester hole pad					
Signal Number	Completed circuit signal number					
End Point Flag	Y/N					
Layer Signal Number	Individual layer signal number					
Layer End Point Flag	Y/N					
Functional Test Point	Flag indicating test point					

3 MODULE MANUFACTURING DATA REQUIREMENTS

The following charts represent the minimum set of data elements and reference data required for the 54-level (module) assembly and test processes.

3.1 IDENTIFICATION INFORMATION

The following product identification information must be included.

Key:

USAGE	= Process user	REQ	= Requirement	SUP	= Supplier of data
F	= Fabrication	A	= Always	E	= Engineering
T	= Test	P	= Product dependent	M	= Manufacturing
R	= Reference				

NOTE

F and T indicate build elements while R denotes a reference element.

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE			REQ	SUP
		50	54	70		
Module Name	Module part number to identify product		FT		A	E
Module Revision	Module part revision		FT		A	E
Data Status	Indicator defining whether this data collection represents a release product, prototype, and so on		FT		A	E
Data Level	Indicator defining level (50, 54, 70) of product represented by this collection of data.		FT		A	E

3.2 DOCUMENT INFORMATION

An index of all applicable product documentation must include the following information.

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE 50	USAGE 54	USAGE 70	REQ	SUP
Document Number	Document numbers for all reference documentation applicable to manufacturing (See DEC STD 140-1, -2 and -3 for requirements)		FT		A	E
Document Revision	Document revisions for all reference documentation.		FT		A	E
Document Type	UA, DD, KPL, and so on		FT		A	E

3.3 COMPONENT INFORMATION

The following information must be provided for every component, discrete, active, and so on used in the product.

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Component Identification			FT		A	E
Part Number	Associated Digital part number					
Part Number Revision	If applicable					
Component Description	A brief description of part					
Component Outline Code	Component outline reference number		FT		A	E
Component Outline	An accurate outline of the component body Attributes required for each outline segment of the component are:					
Line Segment Shape	Straight or curved					
Arc Center	XY location of arc center (if curved)					
Begin XY	Starting coordinate					
End XY	Ending coordinate					
Component Outline Code	Component outline reference number					
Component Pin Data	Pin information is required for each unique electrical component type. Attributes required for each pin of each Component Outline Code are:		FT		A	E
Pin Identifier	An alphanumeric pin identifier					
XY Distance	Distance from the first pin defined					
Comp Outline Code	Component outline reference number					
Miscellaneous Non-electrical part fields						
Component Height	Height of component above the board		R	R	R	R
Component Location	Gives location and component information Attributes required for each reference designator of the circuit are:		FT		A	E
Reference Designator XY Coordinates	Location of first electrical pin designated					
Rotation	0 to 359 degrees					
Mirroring	Mirrored about X or Y axis or neither					
Layer Number	Mounting etch layer number					
Component Specifications	*** to be completed ***		R		A	E

3.4 ELECTRICAL CIRCUIT INFORMATION

The following electrical circuit information must be included.

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Signal Information	Attributes required for each network requiring nomenclature are:		T	T	A	E
Design Signal Number	Logical network number assigned in Design					
Design Signal Name	Logical network name assigned in Design					
Design Network Type	Logic, ground, single point, clock, and so on					
Physical Signal number	Unique Physical net name assigned in Design					

3.5 MISCELLANEOUS ASSEMBLY INFORMATION

The following miscellaneous assembly information must be included.

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	R E Q	S U P
Etch Cut Data	This data is provided only when circuit etch cutting is required Attributes required for each circuit etch cut are:		F		A	E
Cut number	Cut reference number					
XY location	Location of cut					
Layer number	Layer number etch is on					
Depth	Depth of cut					
Cut Side	Side from which cut is made					
Cut Angle	Angle/position of board					
Obstacles	List of obstacles within 0.150 inch radius					
Delete Connection Data	This data must be provided when etch cut or any other form of deleted connection is required for assembly or rework Attributes required for each deleted connection are:		FT		P	E
Change Order No.	Number/name of change order document					
Change Order Step #	Step number in change order referenced					
Deletion Type	Etch cut, drill out and so on					
Location of Delete	XY coordinates etch cut or removed hole					
Deletion Layer	Layer on which deletion is made					

MODULE FABRICATION AND TEST DATA ELEMENTS		USAGE 50	54	70	REQ	SUP
Conductor Angle	Angle of etch to be cut from X axis					
Conductor Size	Size of etch to be cut					
Access Side	Side from which deletion can be accessed					
Dimension of Delete	Length of the cut					
Signal Number	Signal number of connection being cut					
Added Connection Data	This data must be provided when wire is used to establish a previously undefined network connection for assembly rework Attributes required for each added connection are:		FT		P	E
Change Order Number	Number/name of change order document					
Change Order Step No.	Step number in change order referenced					
Wire Type	Standard wire, twisted pair, coax					
From XY	Starting coordinate of added wire					
From Side	Side on which added wire starts					
To XY	End coordinate of added wire					
To side	Side on which added wire ends					
Signal Number	Signal number given to new signal					
Wire Gauge	Gauge of added wire					
Wire Length	Length of added wire					
Wire Color	Color(s) of added wire					
XY Bend Points	Coordinates for bend points if necessary					

APPENDIX A REFERENCED DOCUMENTS

A.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00140-01	*DEC STD 140-1 Documentation Requirements for Printed-Wiring Boards (50-Class)*
EL-00140-02	*DEC STD 140-2 Documentation Requirements for 54-Class Modules and Backplanes*
EL-00140-03	*DEC STD 140-3 Documentation Requirements for Backplanes (54- and 70-Class)*
EL-00140-04	*DEC STD 140-4 Etch Board and Module Release Verification Requirements and Procedures - Data Requirements*

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